Formosan Journal of Surgery (2016) 49, 9–14

Available online at www.sciencedirect.com

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journal homepage: www.e-fjs.com

ORIGINAL ARTICLE

Breast reconstruction modality and outcomes after mastectomy

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Received 14 October 2014; received in revised form 31 October 2014; accepted 11 June 2015
Available online 8 January 2016

KEYWORDS
breast reconstruction;
mastectomy;
outcome study

Abstract *Background:* Choosing a breast reconstructive modality after mastectomy is a critical step involving complex decisions. Postoperative complications can be a significant setback for patients undergoing breast reconstruction. In this study, the results of different reconstructive modalities are recorded and their complications are discussed for further preoperative counseling.
Materials and Methods: Ninety patients who had undergone breast reconstruction at our institution in the past 5 years were reviewed. Clinical encounters for all reconstruction modalities, namely implant-based, autologous tissue, and combined reconstructions, were assessed. We evaluated several clinical variables, such as type of operation, timing of reconstruction, and early and late complications.
Results: Patients were aged 28–61 years, with a mean age of 44.8 years. The body mass index (BMI) ranged from 16.9 to 31.1 kg/m^2, with an average of 22.87 kg/m^2. The follow-up duration ranged from 5.6 to 85.9 months, with a mean of 38.3. Thirty-eight, 46, and 6 patients received implant-based reconstruction, autologous reconstruction, and combined reconstruction, respectively. The most common complication recorded in the implant-based group was hematoma (7.9%), whereas re-exploration (6.5%) and abdominal hernia (6.5%) were the most common complications in the autologous tissue reconstruction group. The average age and BMI of the patients who experienced complications were 46.4 years and 22.5 kg/m^2, respectively, whereas the average age and BMI for the patients without complications were 44 years and 23 kg/m^2, respectively. Complications were most common in patients who underwent adjuvant irradiation and pedicle flap reconstruction (100%).

Conflicts of interest: None of the authors have a financial interest in any of the products, devices, or drugs mentioned in this article.

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http://dx.doi.org/10.1016/j.fjs.2015.06.003

Conclusion: In this small-scale study, we found that an implant-based reconstruction was more frequently performed on older patients. Because of the relatively small average body size and low BMIs of Asian people, obesity is not considered to affect the postoperative complication rate. In addition, postreconstructive irradiation is unlikely to produce additional complications because the patients underwent pedicle flap reconstruction.

1. Introduction

Breast cancer is one of the most common cancers among women worldwide.[1] Postmastectomy breast reconstruction is currently widely used for oncological safety[2–4] and because of its higher psychosocial satisfaction.[5] Breast cancer is generally treated using multimodalities, including surgical resection, hormone therapy, chemotherapy, and radiation. In addition, various postmastectomy reconstructive methods, such as implant-based, autologous tissue, or combined reconstructions, are available.[6] Each of these reconstructive methods has its own benefits and drawbacks.[7] An implant-based reconstruction may provide short surgical and hospitalization time but generates relatively long periods of postoperative complications. By contrast, an autologous tissue reconstruction results in a more durable appearance and a relatively short complication phase; however, it requires long surgical and hospitalization time. By contrast, a combination of the autologous tissue and implant-based reconstructions is an effective compromise because one method can complement the other.

For patients, one of the key satisfaction predictors is the postoperative complication rate.[8] Furthermore, postoperative complications are a considerable setback for patients undergoing breast reconstruction. Therefore, choosing an appropriate reconstructive modality for each individual is a critical step that involves complex considerations. Within the limited scale of this study, the complications arising after the three most common reconstructive modalities are compared to aid preoperative counseling and discussion.

2. Materials and methods

All 90 patients who underwent breast reconstruction at our institution during the past 5 years were reviewed. The clinical encounters of all reconstruction modalities were assessed, which included 38, 46, and 6 patients who underwent implant-based, autologous tissue, and combined reconstructions, respectively. Implant-based reconstruction involved prosthesis and tissue expander placement. The flaps of the autologous reconstruction group included a free deep inferior epigastric perforator (DIEP), free superior gluteal artery (SGA), free transverse rectus abdominis myocutaneous (TRAM), and pedicled-TRAM flaps. The combined reconstruction group solely used the latissimus dorsi (LD) flap with an implant placement (Table 1). Several clinical variables, including patients' type of surgery, time required for the reconstruction, and early and late complications, were reviewed in this study. We defined early and late complications as those that occurred within and after 3 weeks of the surgery, respectively.

The Chi-square test was used for comparing the statistical differences among the different groups. A value of $p < 0.05$ was considered statistically significant, and all confidence intervals were reported within the range of 95%. All calculations were performed using SPSS for Windows, Version 21.0 (Chicago, IL, USA).

3. Results

All patients were aged 28—61 years (mean, 44.8 years). The mean ages of the implant-based, autologous tissue (38 free

Table 1 Age, body mass index types, and timing of breast reconstructions in our study patients.

	Implant-based ($n = 38$)	Autologous ($n = 46$)	Combination ($n = 6$)
Average age	47.8	42.5	42.2
Average BMI	22.35	23.45	20.62
Immediate ($n = 66$)	30	33	3
Delay ($n = 24$)	8	13	3
Types of reconstruction	TE (13) Implant (25)	LD flap (3) Pedicled TRAM flap (8) Free TRAM flap (16) Free DIEP flap (17) Superior gluteal artery flap (2)	LD flap + implant (6)

BMI = body mass index; DIEP = deep inferior epigastric perforator; LD = latissimus dorsi; TE = tissue expander; TRAM = transverse rectus abdominis myocutaneous.

Table 2 Reconstruction modalities in patients receiving adjuvant radiotherapy.

	Implant-based (n = 7)	Autologous (n = 8)	Combination (n = 1)
Neoadjuvant	0	0	0
Adjuvant	TE (3) Implant (4)	LD flap (1) Pedicled TRAM flap (1) Free TRAM flap (3) Free DIEP flap (3)	LD flap + implant (1)

DIEP = deep inferior epigastric perforator; LD = latissimus dorsi; TE = tissue expander; TRAM = transverse rectus abdominis myocutaneous.

flaps and 8 pedicled-TRAM flaps), and combined reconstruction groups were 47.8, 42.5, and 42.2 years, respectively. The body mass index (BMI) ranged from 16.9 to 31.1 kg/m^2 (mean, 22.87 kg/m^2). The three groups had mean BMIs of 22.35, 23.45, and 20.62 kg/m^2, respectively (Table 1). Among these patients, 66 received immediate reconstruction (73.3%) and 24 received a delayed reconstruction (26.7%). In addition, 16 patients—7 patients from the implant-based, 8 from the autologous tissue, and 1 from the combined groups—received irradiation for adjuvant therapy (Table 2).

Postoperative complications were divided into early and late complications for each reconstruction group. In the autologous tissue reconstruction group, all the flaps survived, except for one partial flap loss. We noticed that the autologous reconstruction group had the highest total complication rate (18/46, 39.1%) compared with those of the implant-based and combination reconstruction groups (29% and 33.3%, respectively) with no significant difference (p = 0.268). The most common early complications in the implant-based and autologous tissue groups were hematoma (3/38, 7.9%) and re-exploration (3/46, 6.5%), respectively. The most common late complications in the implant-based reconstruction group were malposition (2/38, 5.3%) and capsular contracture (2/38, 5.3%). Abdominal hernia (3/46, 6.5%) only occurred in the autologous tissue reconstruction group involving two free DIEP flaps and one pedicled-TRAM flap (Table 3).

The average age and BMI of the patients experiencing complications were 46.4 years and 22.5 kg/m^2, respectively, whereas those for patients without complications were 44 years and 23 kg/m^2, respectively. For patients who underwent immediate reconstruction, the complication rate was 33.3% (22/66), whereas it was 37.5% (9/24) for patients who underwent delayed reconstruction.

In the autologous tissue reconstruction group, six patients who received adjuvant irradiation and underwent free flap reconstruction showed no complications. By contrast, 9 of the 29 patients (31%) who did not undergo irradiation experienced complications. Among the patients undergoing a pedicle flap (one LD and one pedicled-TRAM flap) reconstruction, two patients receiving adjuvant irradiation (100%) showed complications of seroma and wound dehiscence. Among four patients receiving adjuvant irradiation and an implant-based reconstruction, one patient experienced dehiscence, whereas no complications were observed in three patients undergoing adjuvant irradiation and tissue expander reconstruction. One patient in the combined reconstruction group undergoing irradiation experienced partial flap necrosis and required dèbridement and wound closure.

A higher complication rate was observed in patients with pedicle flap reconstructions (LD and pedicled-TRAM; 72.7%, 8/11) than in those receiving free flap reconstructions (free TRAM, DIEP, and SGA; 28.6%, 10/35). Furthermore, the complication rate further reduced to 54.5% in patients with

Table 3 Complications after various breast reconstruction methods.

	Implant-based		Autologous					Combination
	Implant (25)	TE (13)	LD (3)	p-TRAM (8)	f-TRAM (16)	DIEP (17)	SGA (2)	LD + Implant (6)
Early								
Hematoma	3	-	-	-	-	-	-	1
Infection	-	-	-	1	-	1	-	-
Wound dehiscence	1	-	-	1	-	-	-	-
Fat necrosis	-	-	-	1	1	-	-	-
Reopen	-	-	-	-	1	1	1	-
Flap total loss	-	-	-	-	-	-	-	-
Flap partial loss	-	-	-	1	-	-	-	1
Seroma	1	1	1	-	-	-	-	-
Late								
Abdominal hernia	-	-	-	1	-	2	-	-
Scar	-	1	-	2	1	2	-	-
Malposition	1	1	-	-	-	-	-	-
Capsule contracture	1	1	-	-	-	-	-	-

DIEP = deep inferior epigastric perforator; f-TRAM = Free TRAM; LD = latissimus dorsi; p-TRAM = pedicled TRAM; SGA = superior gluteal artery; TE = tissue expander.

pedicle flap reconstruction (6/11), but the rate was higher than that observed for those with free flap reconstruction.

After breast reconstructions, 8.9% of the patients underwent secondary procedures, including scar revision and release contracture (Table 4).

4. Discussion

Breast cancer is a neoplasm that is being seen more often in female patients. To meet the rising demand for enhanced aesthetic appearance, breast reconstruction has been widely performed after mastectomy for boosting the self-confidence and quality of life in many female patients.[9] Various reconstructive methods have their own contraindications, advantages, and disadvantages.[7] Implant-based reconstruction is associated with a short surgical and hospitalization time without donor site morbidity; however, there is the risk of capsular contracture and implant malposition.[10,11] By contrast, autologous tissue reconstruction has a long surgical and hospitalization time with risks of flap failure, donor site morbidity, and scar formation; however, it provides a more natural appearance and efficient protection from irradiation.[12–14] Combined reconstruction can provide a neutral balance between the implant-based and autologous tissue reconstruction methods.[15] Because of the presence of multiple reconstructive modalities and cofactors, balancing patient safety and expectation is difficult.[16] Therefore, preoperative discussions among plastic surgeons, general surgeons, and patients are essential before a patient begins the process of breast reconstruction. The preoperative issues are discussed herein.

4.1. Age

Age is one of the most crucial factors influencing patients' desire to undergo breast reconstruction after mastectomy.[17] Furthermore, because of the higher probability of comorbidities among older patients, a less time-intensive and simple reconstruction method is preferred.[18,19] This surgical strategy is consistent with our surgical strategies. Although the mean age of the patients in the implant-based reconstruction group (47.8 years) was higher than that of patients in the other two groups (42.2 and 42.5 years in autologous tissue and combined reconstruction groups, respectively), the differences among the groups were nonsignificant (implant vs. autologous, $p = 0.777$; implant vs. combined, $p = 0.808$; autologous vs. combined, $p = 0.720$).

The average age of patients experiencing complications was 46.4 years, whereas that of patients without complications was 44 years, with no major statistical difference ($p = 0.066$) between the two groups.

Table 4 Secondary procedures for breast reconstruction.

	Implant-based ($n = 38$)	Autologous ($n = 46$)	Combination ($n = 6$)	Total ($n = 90$)
Scar revision	1	5	-	6.7%
Release contracture	2	-	-	2.2%
Redo flap	-	-	-	0%
Total	7.9%	10.9%	0%	8.9%

4.2. Body mass index

The World Health Organization (WHO) defines individuals with BMI > 25 kg/m^2 as overweight and those with BMI > 30 kg/m^2 as obese. According to the WHO grading system, Asian people have a relatively small body size; therefore, the BMI values are modified. For Asians, BMI > 23 kg/m^2 is considered overweight and BMI > 25 kg/m^2 is considered obese. Furthermore, the Taiwan Ministry of Health classifies BMI > 24 kg/m^2 as overweight and BMI > 27 kg/m^2 as obese. Obesity is one of the main risk factors for postmastectomy reconstruction complications irrespective of the reconstruction method employed.[20,21] In this study, we observed that the average BMI of patients experiencing complications was 22.5 kg/m^2, whereas that of patients without complications was only 23, with no significant difference ($p = 0.519$). This result may relate well with the Asian population who have a relatively small body weight; this was true for our patients, 11 of whom were obese and 16 overweight.

4.3. Timing

An immediate postmastectomy breast reconstruction not only ensures oncological safety and a single-stage reconstruction but also yields a more satisfied body image, femininity, and sexuality.[22] In our study, most patients (66/90, 73.3%) underwent immediate reconstruction after mastectomy. By contrast, delayed breast reconstruction is optimal for patients with more advanced breast cancers who are at a high risk of recurrence and requiring adjuvant therapies, specifically irradiation.[23] Accordingly, only 26.7% of our patients received delayed reconstructions. Patients who underwent immediate reconstruction exhibited a lower complication rate (33.3%) than that observed among those who underwent delayed reconstruction (37.5%), with no significant difference ($p = 0.461$). Although immediate reconstructions are beneficial, we believe that patients' preferences, adjuvant chemotherapy, and irradiation are essential aspects that must be considered before deciding on the timing of the reconstructive surgery.

4.4. Individual complication rate

Studies have reported complication rates of implant-based, autologous tissue, and combined reconstruction groups as 5.8–49%, 22.6–44.3%, and 29.8%, respectively.[24,25] Our results are consistent with these findings; the complication rate of the autologous tissue reconstruction group (36.9%) was higher than that of the implant-based (29%) and combined (33.3%) reconstruction groups. However, the differences among the groups were nonsignificant.

4.5. Radiotherapy

Radiation treatment is commonly considered a risk factor for postoperative complications in breast reconstructions after mastectomy; both postoperative ablation and anticipated irradiation have the same effects.[26,27] In our series, of the 16 patients receiving adjuvant radiotherapy, 4 patients showed complications: 2 patients with pedicled-TRAM and implant-based reconstructions experienced wound dehiscence, 1 patient with an LD reconstruction experienced seroma, and 1 patient with a combined reconstruction experienced a partial flap loss. Patients who underwent radiotherapy had an early complication rate of 25% (4/16), whereas those who did not undergo radiotherapy had comparable early and late complication rates of 18.9% (14/74) and 17.6% (13/74), respectively (Table 5). The differences in radiotherapy affecting early ($p = 0.586$) and late ($p = 0.81$) complications between the two groups were nonsignificant. By isolating the effect of radiation, the complication rates for implant-based, autologous tissue, and combined reconstruction were 27%, 36.4%, and 20%, respectively, but with no significant differences (implant vs. autologous, $p = 0.325$; implant vs. combined, $p = 0.979$; autologous vs. combined, $p = 0.635$). Nevertheless, radiotherapy after a reconstructive surgery increases the prospect of postoperative early complications[28]; this is consistent with our finding that 25% of patients receiving adjuvant radiotherapy experienced early complications; however, only 18.9% of the patients without radiotherapy experienced early complications.

4.6. Free flap or pedicle flap

Differences between the complications arising from the pedicle flap (pedicled-TRAM and LD) and free flap reconstructions, such as free TRAM, free DIEP, free SGA, and free LD, have been extensively studied.[29] Although fat and flap necrosis appear more in patients who underwent pedicled-TRAM reconstruction, an increasing number of reconstructive surgeons believe that no substantial evidence differentiating the pedicled-TRAM from the free flap reconstruction method has been reported.[30] Among the limited number of cases observed in our study, the patients who underwent pedicle flap reconstruction had a significantly higher ($p = 0.04$) complication rate (72.7%) than did those who underwent free flap reconstruction (28.6%). After isolating the effect of irradiation, the complication rate in patients who underwent pedicle flap reconstruction was 54.5%. We speculate that a study involving analysis of variance will yield similar results regarding the effects of irradiation on the complication rates in these two groups.

Table 5 Radiotherapy effects on early and late complications.

	Radiotherapy ($n = 16$)	Nonradiotherapy ($n = 74$)
Early complications	4	14
Late complications	0	13

Because of the limited number of patients in this study, justifying all our findings is not feasible; however, we clarified related postmastectomy breast reconstruction—related topics by referring to relevant literature. The results of this study serve as reference for patient—doctor preoperative counseling; however, additional studies are necessary.

5. Conclusion

Implant-based reconstruction appears to be the most preferable option for older patients after mastectomy. Because of the relatively small body size and BMIs among Asian patients, obesity may not be influential in the development of postoperative complications. Although immediate reconstruction may provide oncological safety and psychosocial comfort, delayed reconstruction is still the preferred choice for patients, specifically for those at high risk of local recurrence or metastasis. Adjuvant radiation therapy can lead to complications after breast reconstruction; however, the high influence of radiotherapy on the complication rate of patients receiving pedicle flap reconstruction remains unclear.

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